CyWee Group Ltd. v. Samsung Electronics Co., Ltd. & Samsung Electronics America, Inc.

Defendants' Claim Construction Arguments

April 17, 2018

“utilizing a comparison to compare the first signal set with the second signal set”

’438 Patent, Claim 1

Samsung’s Construction	CyWee’s Construction
Indefinite	“determining or assessing differences based on a previous state associated with the first signal set and a measured state associated with the second signal set while calculating deviation angles”

“utilizing a comparison to compare the first signal set with the second signal set”

- Claim 1 requires comparing angular velocities with axial accelerations.
- The experts agree that “axial accelerations” has multiple reasonable interpretations.
- Each possible interpretation yields a different claim scope.
- It is mathematically impossible to compare linear, centrifugal or gravitational acceleration with an angular velocity.
- CyWee’s expert cannot resolve the ambiguity by pointing to an Extended Kalman filter.

Claim 1 requires comparing angular velocities with axial accelerations

1. A three-dimensional (3D) pointing device subject to movements and rotations in dynamic environments, comprising:

a housing associated with said movements and rotations of the 3D pointing device in a spatial pointer reference frame;

a printed circuit board (PCB) enclosed by the housing;

a six-axis motion sensor module attached to the PCB, comprising a rotation sensor for detecting and generating a first signal set comprising angular velocities ωx, ωy, ωz associated with said movements and rotations of the 3D pointing device in the spatial pointer reference frame, an accelerometer for detecting and generating a second signal set comprising axial accelerations Ax, Ay, Az associated with said movements and rotations of the 3D pointing device in the spatial pointer reference frame; and

a processing and transmitting module, comprising a data transmitting unit electrically connected to the six-axis motion sensor module for transmitting said first and second signal sets thereof and a computing processor for receiving and calculating said first and second signal sets from the data transmitting unit, communicating with the six-axis motion sensor module to calculate a resulting deviation comprising resultant angles in said spatial pointer reference frame by utilizing a comparison to compare the first signal set with the second signal set whereby said resultant angles in the spatial pointer reference frame of the resulting deviation of the six-axis motion sensor module of the 3D pointing device are obtained under said dynamic environments, wherein the comparison utilized by the processing and transmitting module further comprises an update program to obtain an updated state based on a previous state associated with said first signal set and a measured state associated with said second signal set; wherein the measured state includes a measurement of said second signal set and a predicted measurement obtained based on the first signal set without using any derivatives of the first signal set.

’438 Patent at Claim 1

The experts agree that "axial accelerations" has multiple interpretations

66. First, a POSA would have understood that the term "axial accelerations" could have multiple possible interpretations. Specifically, an "axial acceleration" could connote the combination of one or multiple possible acceleration components resulting from: (i) the force of gravity; (ii) external forces that impose linear accelerations; and (iii) centrifugal forces producing non-straight line motion that impose one or more centrifugal accelerations (since the structures imposing the centrifugal accelerations are not necessarily a single rigid body).

Mercer Decl. (March 9, 2018) at ¶ 66

The experts agree that "axial accelerations" has multiple interpretations

29. Regarding Dr. Mercer's first reason, axial accelerations can have multiple interpretations depending on the 3 type of forces (gravity, linear, centrifugal) that can act on an accelerometer. However, this is immaterial because the '438 patent acknowledges this fact and specifically teaches how using sensor fusion (i.e., an extended Kalman filter) to combine the accelerometer and gyroscope information can be used to calculate deviation angles for a 3D pointing device. Thus, any person of ordinary skill in the art would indeed understand the nature of axial accelerations and also understand that the ambiguity is not vital in the context of the '438 patent.

LaViola Decl. (February 23, 2018) at ¶ 29

Comparing angular velocity with linear or gravitational acceleration is mathematically impossible

90. If the axial acceleration is interpreted as being based upon an object's linear acceleration, it is mathematically impossible to compare that object's linear acceleration with an equivalent angular velocity.

91. If at least part of the object's axial acceleration is interpreted as being based upon gravitational acceleration, it is also mathematically impossible to compare the object's gravitational acceleration with its angular velocity.

92. This is because generally each of: (i) the angular velocity of an object; (ii) the linear acceleration of that same object; and (iii) gravitational accelerations experienced by that object are all mutually independent. In other words, an object's linear and gravitational accelerations do not affect its angular velocity.

Mercer Decl. (March 9, 2018) at ¶¶ 90–92

Comparing angular velocity with centrifugal acceleration is mathematically impossible

95. Although the magnitude of the centrifugal acceleration is related to the object's angular velocity, the centrifugal acceleration also depends on the radius of curvature of the motion's curved path.

96. Thus, even in the simplest case of circular rotation, in order to relate an instantaneous centrifugal force to a corresponding instantaneous angular velocity, the instantaneous radius of rotation must be known. The specifications of the patents-in-suit never discuss this problem or propose a solution for it.

Mercer Decl. (March 9, 2018) at ¶¶ 95-96

Extended Kalman filters do not make the comparison possible

150. As described above, an Extended Kalman filter is designed to deal with system and measurement noises which are uncorrelated zero mean white noise processes with known auto covariance functions. An Extended Kalman filter is not designed to partition accelerometer readings into linear, centrifugal and gravitational acceleration components and compare axial accelerations with angular velocities, and neither the '438 Patent nor Dr. LaViola disclose how an Extended Kalman filter would do so.

Mercer Decl. (March 9, 2018) at ¶ 150

CyWee's equations contain undefined functions and variables, and entirely omit angular velocities and axial accelerations

Equation 5	$x(t\|t-1) = f(x_{t-1}, u_t)$
Equations 6-7	$P(x_t \mid x_{t-1}, u_t) = F_x P(x_t \mid x_{t-1}) \quad P(u_{t-1} \mid u_{t-1}) F_u^T + Q_t$ $F_x = \frac{\partial f(x_{t-1}, u_t)}{\partial x_{t-1}} \quad f(x_{t-1}, u_t) \over \partial u_t$
Equation 8	$z_t(t\|t-1) \quad (t\|t-1))$
Equations 9-10	$P(z_t \mid x_t) = H \quad \mid x_{t-1}) H_x^T + R_t$ $H_x = \frac{\partial h(x(t \mid t-1))}{\quad t-1)}$
Equation 11	$D_t = \{[z_t - h(z(t\|t-1))] P(z_t\|x_t) [z_t - h(x(t\|t-1))]^{-1}\}^{1/2}$

Even CyWee's expert does not fully understand the supposed comparison

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IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

CYWEE GROUP LTD.,)
Plaintiff,)
vs.) Case No. 2:17-CV-00140-RWS-RSP
SAMSUNG ELECTRONICS CO., LTD., AND SAMSUNG ELECTRONICS AMERICA, INC.,)
Defendants.)

DEPOSITION OF
JOSEPH J. LAVIOLA, JR., PH.D.
Orlando, Florida
Wednesday, March 7, 2018

Reported by:
RHONDA HALL-BREUWET, RDR, CRR, LCR, CCR, FPR, CLR, NCRA Realtime Systems Administrator
JOB NO. 138800

TSG Reporting - Worldwide 877-702-9580

Q. So in terms of the actual calculations that you would use, which equations would those be?

A. The actual equations? Turns out it's going to be -- the actual equation that will do the comparison is Equation 11.

. . .

Q. And what does Equation 11 do?

A. Equation 11 is -- Equation 11 is --it's slightly unclear what Equation 11 is doing. But based on the mathematics in it, it is either going to combine the two measurements -- it is combining the two measurements together, the quaternion from the measurement and the quaternion from the process, combining them and outputting that quaternion with the weights from the covariance matrix, or it's going to be computing a new error term that can be used to calculate the quaternion.

Dr. LaViola's testimony cannot resolve the ambiguity

- As a matter of law, an expert's findings cannot resolve an ambiguity in the intrinsic evidence regarding the meaning of a claim term.

Teva Pharmaceuticals USA, Inc. v. Sandoz, Inc., 789 F.3d 1335 (Fed. Cir. 2015)

Dr. Mercer far exceeds CyWee's definition of a POSA

> 11. A person of ordinary skill in the art at the time of the filing of the '438 and '978 patents would typically have at least a Bachelor's Degree in Computer Science, Electrical Engineering, Mechanical Engineering, or Physics, or equivalent work experience, along with knowledge of sensors (such as accelerometers, gyroscopes, and magnetometers), and mobile computing technologies.

LaViola Decl. (February 23, 2018) at ¶ 11

Dr. Mercer far exceeds CyWee's definition of a POSA

Mercer Qualifications

- Professor Emeritus of Electrical Engineering and Computer Engineering at Texas A&M
- Forty-seven years of industry and academic experience
- B.S. in Electrical Engineering from Texas Tech
- M.S. in Electrical Engineering from Stanford University
- Ph.D in Electrical Engineering from the University of Texas at Austin
- Extensive experience with data collection using orientation sensors and filtering and estimation techniques

“comparing the second quaternion in relation to the measured angular velocities ωx, ωy, ωz of the current state at current time T with the measured axial accelerations Ax, Ay, Az and the predicted axial accelerations Ax’, Ay’, Az’ also at current time T”

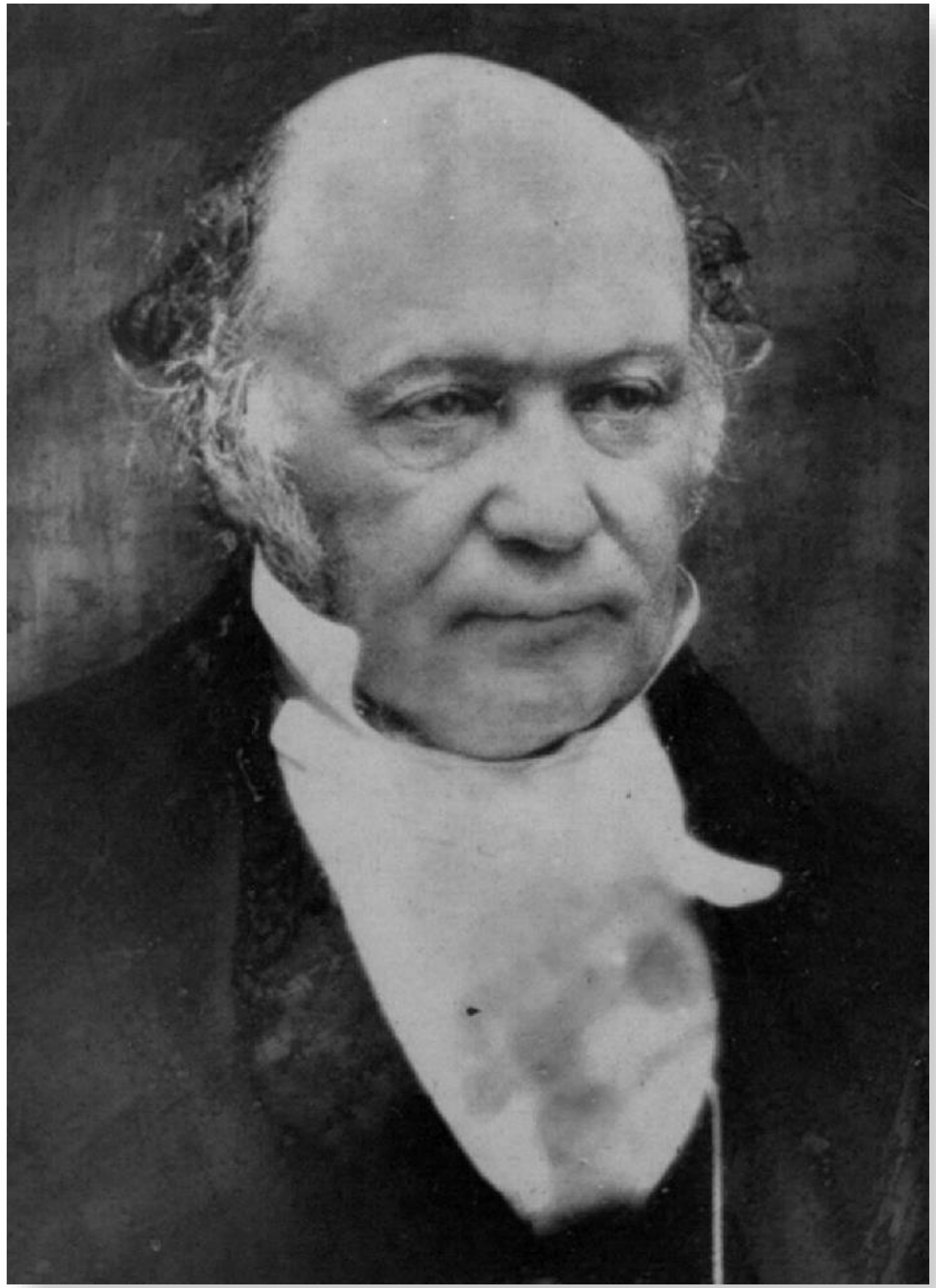
’438 Patent, Claims 14 and 19

Samsung’s Construction	CyWee’s Construction
Indefinite	This term need not be construed. In the alternative, this term may be construed as follows: “**utilizing** the second quaternion obtained from the measured angular velocities ωx, ωy, ωz of the current state at current time T, the measured axial accelerations Ax, Ay, Az, and the predicted axial accelerations Ax’, Ay’, Az’ also current time T to obtain an updated state or updated quaternion”

"comparing the second quaternion in relation to the measured angular velocities ωx, ωy, ωz of the current state at current time T with the measured axial accelerations Ax, Ay, Az and the predicted axial accelerations Ax', Ay', Az' also at current time T"

- Claims 14 and 19 require comparing a second quaternion in relation to angular velocities with axial accelerations.
- This term is indefinite for the same reasons as "utilizing a comparison."
- A quaternion is a mathematical tool for representing an object's rotation. It does not make comparing angular velocities with axial accelerations mathematically possible.

A quaternion is merely a mathematical notation



William Rowan Hamilton

$$\mathbf{q} = (q_0, q_1, q_2, q_3)$$

A quaternion is merely a mathematical notation

173. The fact that claims 14 and 19 recite a "second **quaternion** in relation to the measured angular velocities" does not change my analysis.

174. A POSA would have understood that a quaternion is just a mathematical notation. A "quaternion in relation to the measured angular velocities" is therefore a mathematical tool which can be used for calculating and analyzing an object's angular rotation. As described above in ¶ 118, not all the tools of elementary algebra are available using quaternions. The '438 Patent does not discuss this fact or discuss its implications with respect to the utilization of quaternions in the '438 Patent, including in Equations (5) through (11) discussed in more detail below.

Mercer Decl. (March 9, 2018) at ¶¶ 173-174

A quaternion is merely a mathematical notation

175. Accordingly, the fact that this value is in quaternion representation does not remedy the fact that it is: (i) mathematically impossible to compare a quaternion representing the object's angular rotation with its linear acceleration; (ii) mathematically impossible to compare a quaternion representing the object's angular rotation with its gravitational acceleration; (iii) mathematically impossible to compare a quaternion representing the object's angular rotation with its centrifugal acceleration; and (iv) mathematically impossible to do any of these comparisons while also performing a comparison with the "predicted axial accelerations." This is so unless there is a known constant radius of rotation and a known, constant center of rotation, which is practically impossible. This is particularly true because the patent claims a pointing device, which by its nature may be moved as the user wishes, not with a fixed radius and center of rotation.

Mercer Decl. (March 9, 2018) at ¶ 175

“generating the orientation output based on the first signal set, the second signal set and the rotation output or based on the first signal set and the second signal set”

’978 Patent, Claim 10

Samsung’s Construction	CyWee’s Construction
Indefinite	This term need not be construed. In the alternative, this term may be construed as follows: “generating the orientation/deviation angle output based on (1) the first signal set (from an accelerometer), the second signal set (from a magnetometer) and the rotation output (from a rotation sensor or gyroscope) or (2) the first signal set (from an accelerometer) and the second signal set (from a magnetometer)”

"generating the orientation output based on the first signal set, the second signal set and the rotation output or based on the first signal set and the second signal set"

- Claim 10 recites generating the orientation output based on:
  i. the axial accelerations, the magnetisms, and the rotation output; or
  ii. the axial accelerations and the magnetisms.
- The second option (ii) is indefinite for the same reasons as "utilizing a comparison" and "comparing the second quaternion."
- Generating the orientation output based on the axial accelerations and the magnetisms is mathematically impossible because the axial accelerations include multiple components when the 3D pointing device is moving.

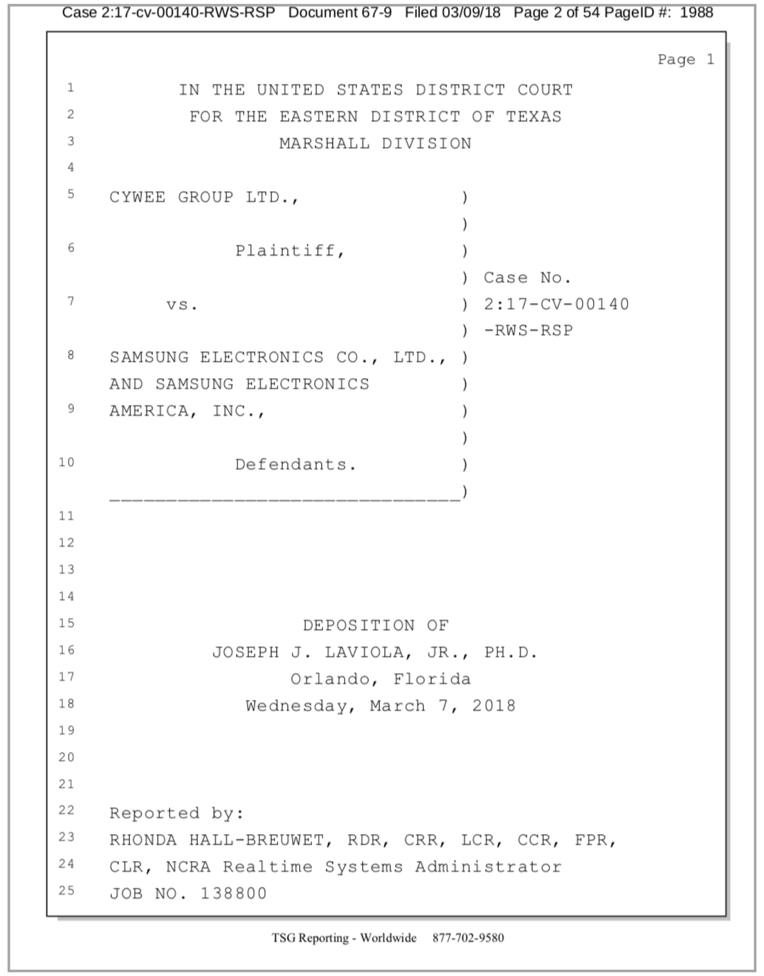
Generating the orientation output based on axial accelerations and magnetisms is impossible when the 3D pointing device is moving

- The 3D pointing device experiences accelerations other than gravitational acceleration when it is moving, but . . .

> 199. A POSA would have understood that it is only mathematically possible to generate an orientation output based on "axial accelerations" and magnetism readings if the axial accelerations are interpreted to be based exclusively on the gravitational accelerations.

Mercer Decl. (March 9, 2018) at ¶¶ 199-200

CyWee's expert testified there are two ways of generating the orientation based on axial accelerations and magnetisms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MARSHALL DIVISION

CYWEE GROUP LTD., Plaintiff, vs. SAMSUNG ELECTRONICS CO., LTD., AND SAMSUNG ELECTRONICS AMERICA, INC., Defendants.

Case No. 2:17-CV-00140-RWS-RSP

DEPOSITION OF
JOSEPH J. LAVIOLA, JR., PH.D.
Orlando, Florida
Wednesday, March 7, 2018

Reported by:
RHONDA HALL-BREUWET, RDR, CRR, LCR, CCR, FPR, CLR, NCRA Realtime Systems Administrator
JOB NO. 138800

TSG Reporting - Worldwide 877-702-9580

A. So Equations 26 through 28 will provide orientation -- an estimate of orientation based on the accelerometer and the magnetometer, given that the device is stationary. So that, in and of itself, provides an additional component to enhance the comparison method. It's an either/or proposition essentially. You can use this or you can use the enhanced comparison method to get the orientation.

. . .

Q. But if the device is moving or we want to use the gyroscope, we have to go back to that extended Kalman filter --

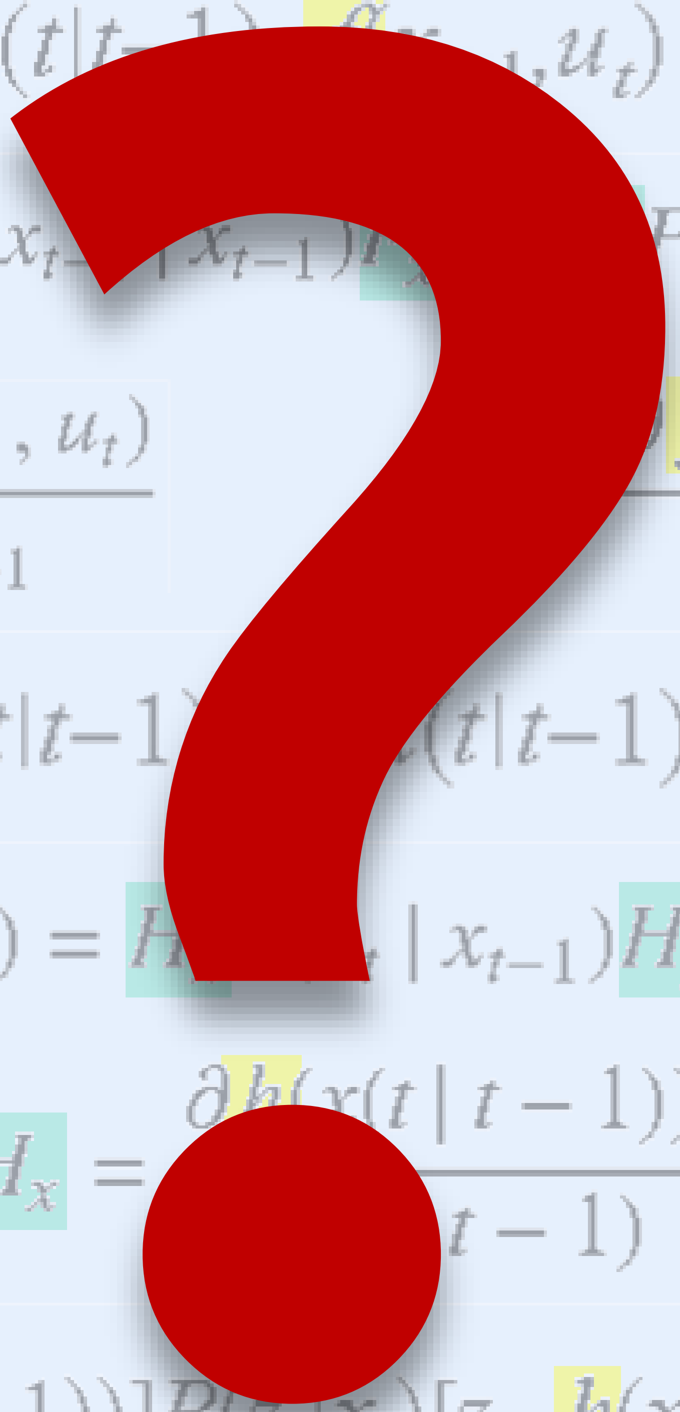
A. Yes.

Q. -- in 5 through 11?

A. Uh-huh.

LaViola Deposition (March 7, 2018) at 161:12-21 and 162:19-24

The second method (Equations 5-11) does not use the variables for magnetisms



Equation 5	$x(t\|t-1) \ldots g \ldots , u_t)$
Equations 6-7	$P(x_t \mid x_{t-1}, u_t) = F_x P(x_t \ldots \mid x_{t-1}) F \ldots P(u_{t-1} \mid u_{t-1}) F_u^T + Q_t$ $F_x = \frac{\partial f(x_{t-1}, u_t)}{\partial x_{t-1}}$ … $\frac{\ldots f(x_{t-1}, u_t)}{\partial u_t}$
Equation 8	$z_t(t\|t-1 \ldots (t\|t-1))$
Equations 9-10	$P(z_t \mid x_t) = H \ldots \mid x_{t-1}) H_x^T + R_t$ $H_x = \frac{\partial h(x(t \mid t-1))}{\ldots t-1)}$
Equation 11	$D_t = \{[z_t - h(z(t\|t-1))] P(z_t\|x_t)[z_t - h(x(t\|t-1))]^{-1}\}^{1/2}$

Extended Kalman filters do not make generating the orientation output possible

219. Second, as I discussed above in ¶¶ 150–152, Extended Kalman filters are designed to deal with system and measurement noises. An Extended Kalman filter is not designed to partition accelerometer readings into linear, centrifugal and gravitational acceleration components and neither the '978 Patent nor Dr. LaViola disclose how an Extended Kalman filter would do so.

Mercer Decl. (March 9, 2018) at ¶ 219

“three-dimensional (3D) pointing device” / “3D pointing device”

’438 Patent, Claims 1, 3–5, 14–17, 19; ’978 Patent, Claim 10

Samsung’s Construction	CyWee’s Construction
“a device that detects the motion of the device in three-dimensions and translates the detected motions to **control the movement of a cursor or pointer on a display**”	This term need not be construed. In the alternative, this term may be construed as follows: “a handheld device that uses at least a rotation sensor comprising one or more gyroscopes, and one or more accelerometers to **determine deviation angles or the orientation of a device.**”

“three-dimensional (3D) pointing device” / “3D pointing device”

- The ’978 Patent specifically distinguishes 3D pointing devices from other types of devices, including motion detectors, navigation equipment, and a communication device integrated with motion sensors.
- CyWee’s expert agrees that a 3D pointing device is different from these types of devices and must render a graphical element on a screen that moves with respect to the device.
- Every embodiment disclosed in the patents is consistent with Samsung’s construction.
- Samsung’s construction is consistent with the extrinsic evidence.

The ’978 Patent distinguishes 3D pointing devices from other types of devices

In addition, as the trend of 3D technology advances and is applicable to various fields including displays, interactive systems and navigation, there is a significant need for an electronic device, including for example a motion detector, a 3D pointing device, a navigation equipment, or a communication device integrated with motion sensors therein, capable of accurately outputting a deviation of such device readily useful in a 3D or spatial reference frame.

’978 Patent at 3:63-4:4

CyWee's expert agrees with Samsung's construction

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Q. This says in the paragraph that there's a number of devices that can accurately calculate their own orientation, and a 3D pointing device is one of them.

A. Uh-huh.

Q. So, for example, just a communication device integrated with sensors, that can calculate its own orientation?

A. Yes.

Q. So what's the difference between that and a 3D pointing device?

A. Well, the 3D pointing device is being used for probably a specific function over the communication device or the motion detector. The motion detector could be simply to detect motion of a person -- communication device, so I know something about where the device is located in the world. The difference is 3D pointing device is actually something that's used in the orientation to support a number of activities, including pointing and also understanding -- or providing direction and/or orientation information that can be utilized to render graphical elements on a screen so that they'll move with respect to the device.

All embodiments are consistent with Samsung's construction

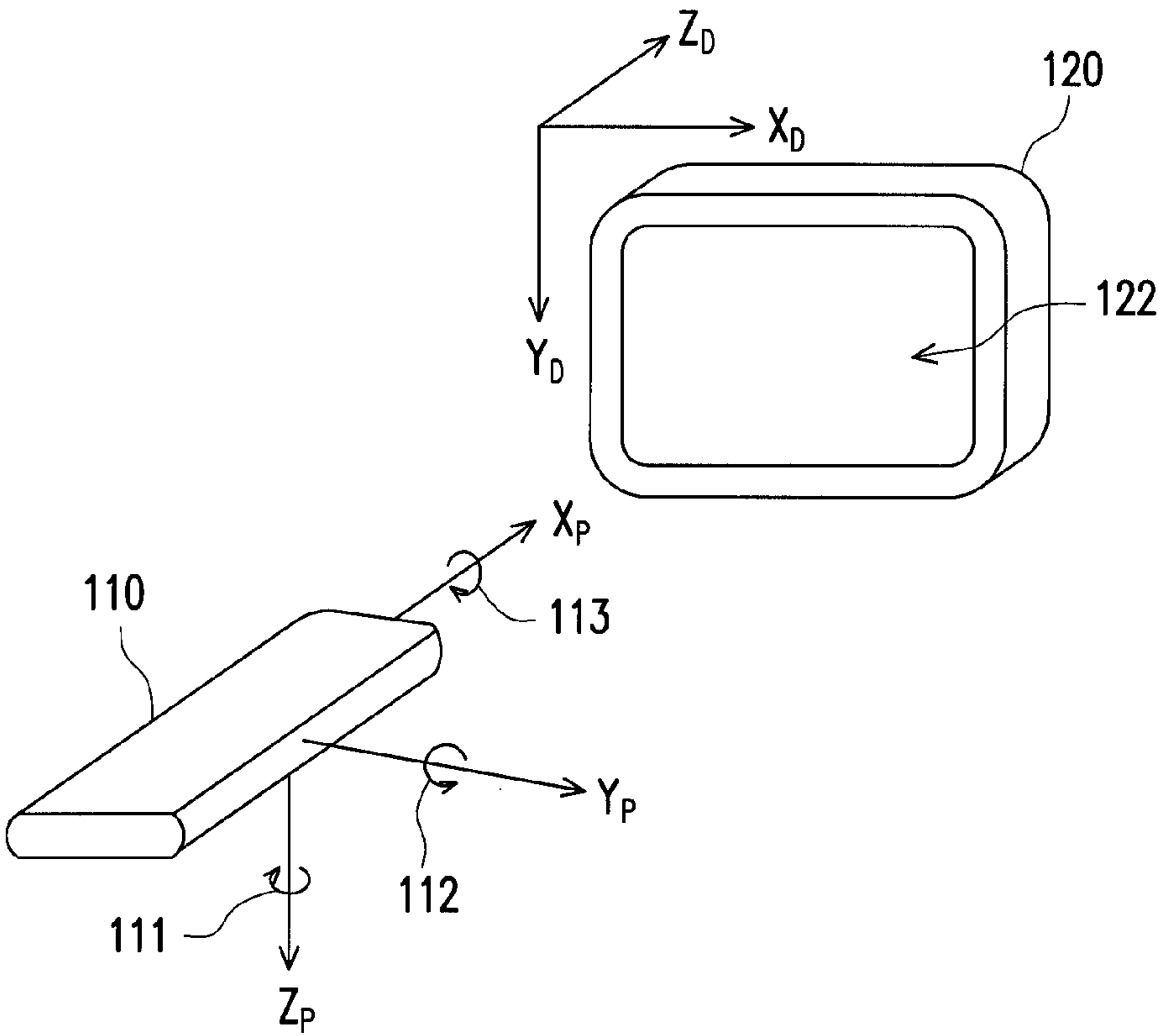


FIG. 1 (RELATED ART)

'438 Patent at Fig. 1

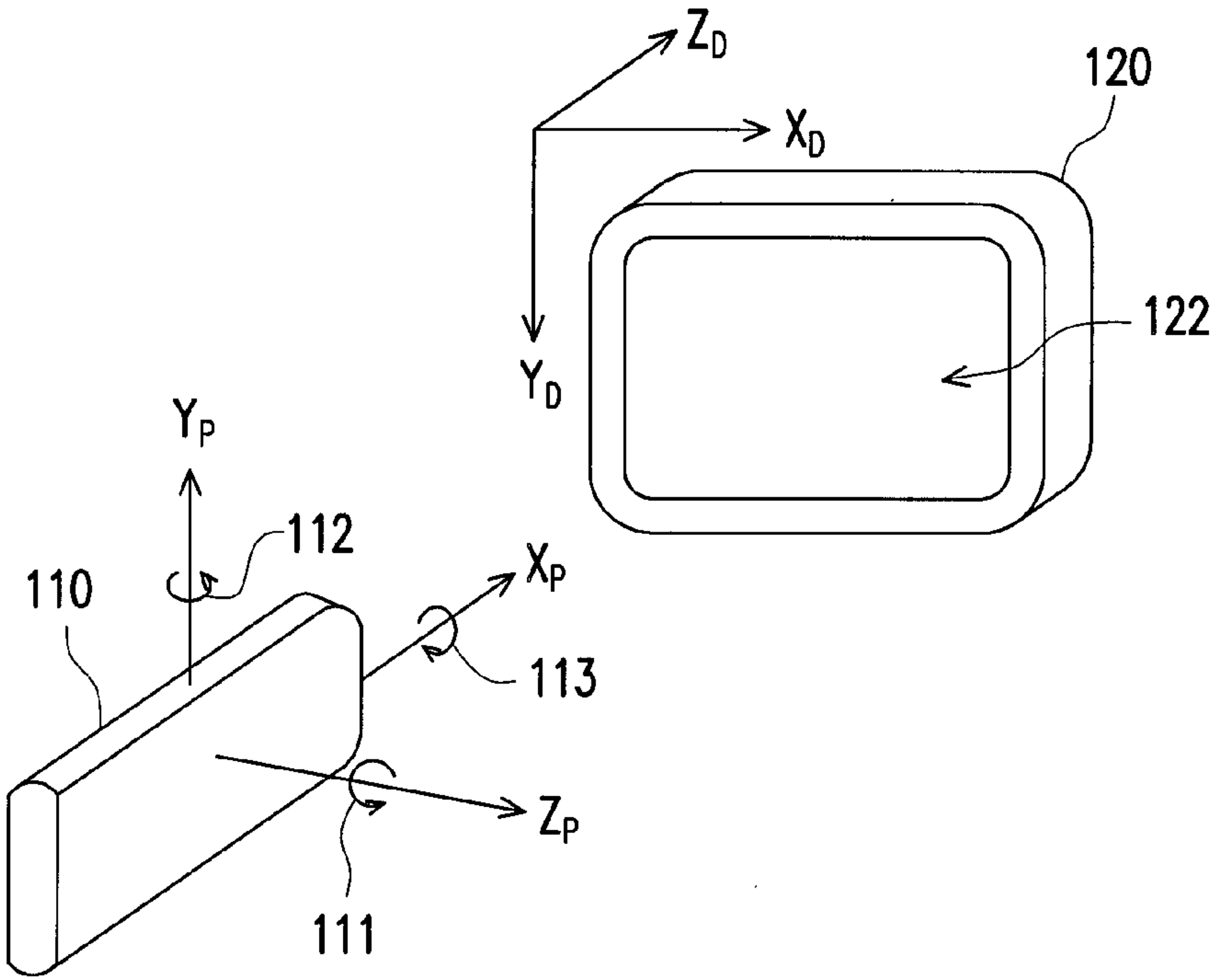


FIG. 2 (RELATED ART)

'438 Patent at Fig. 2

All embodiments are consistent with Samsung's construction

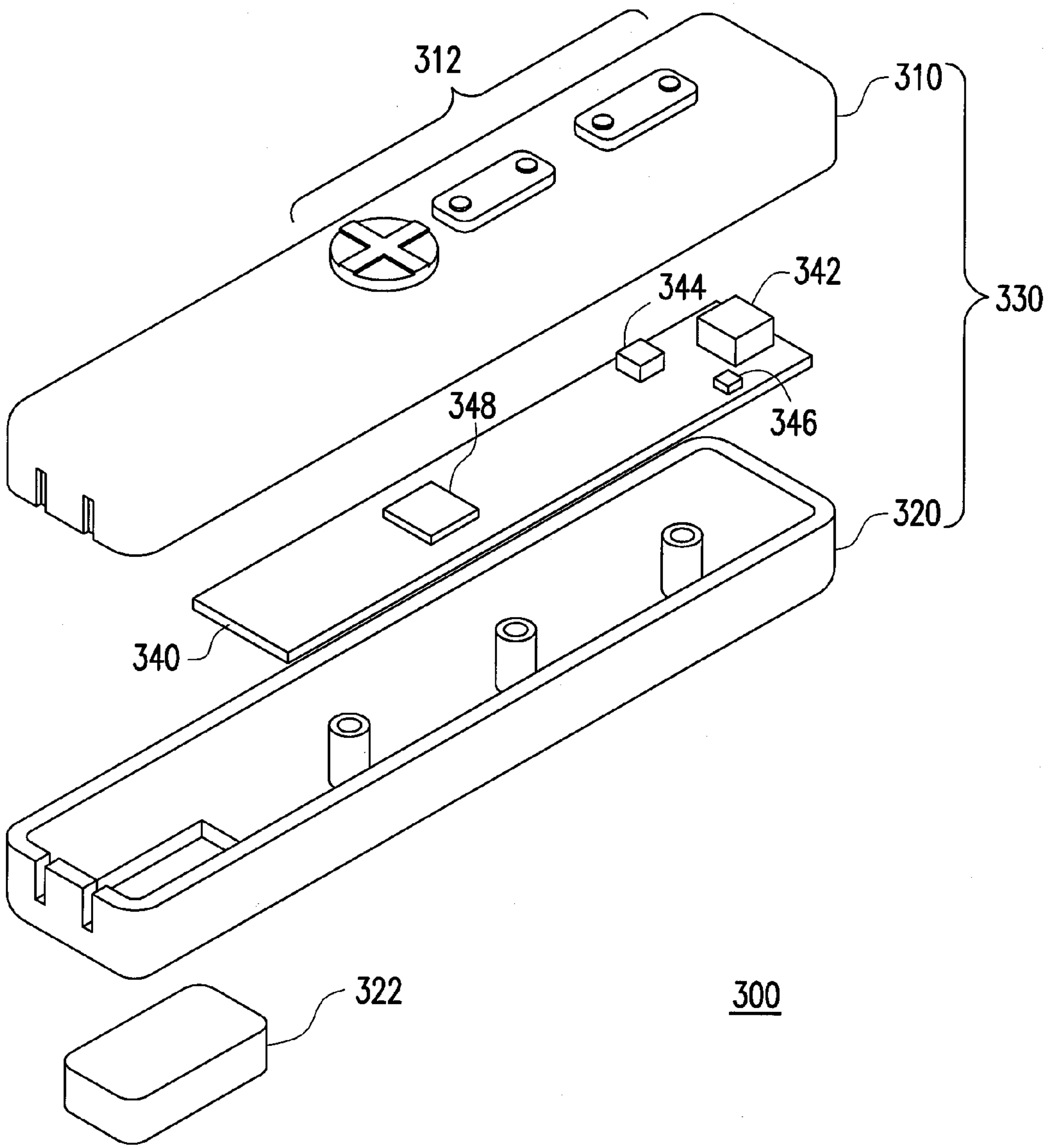


FIG. 3

'438 Patent at Fig. 3

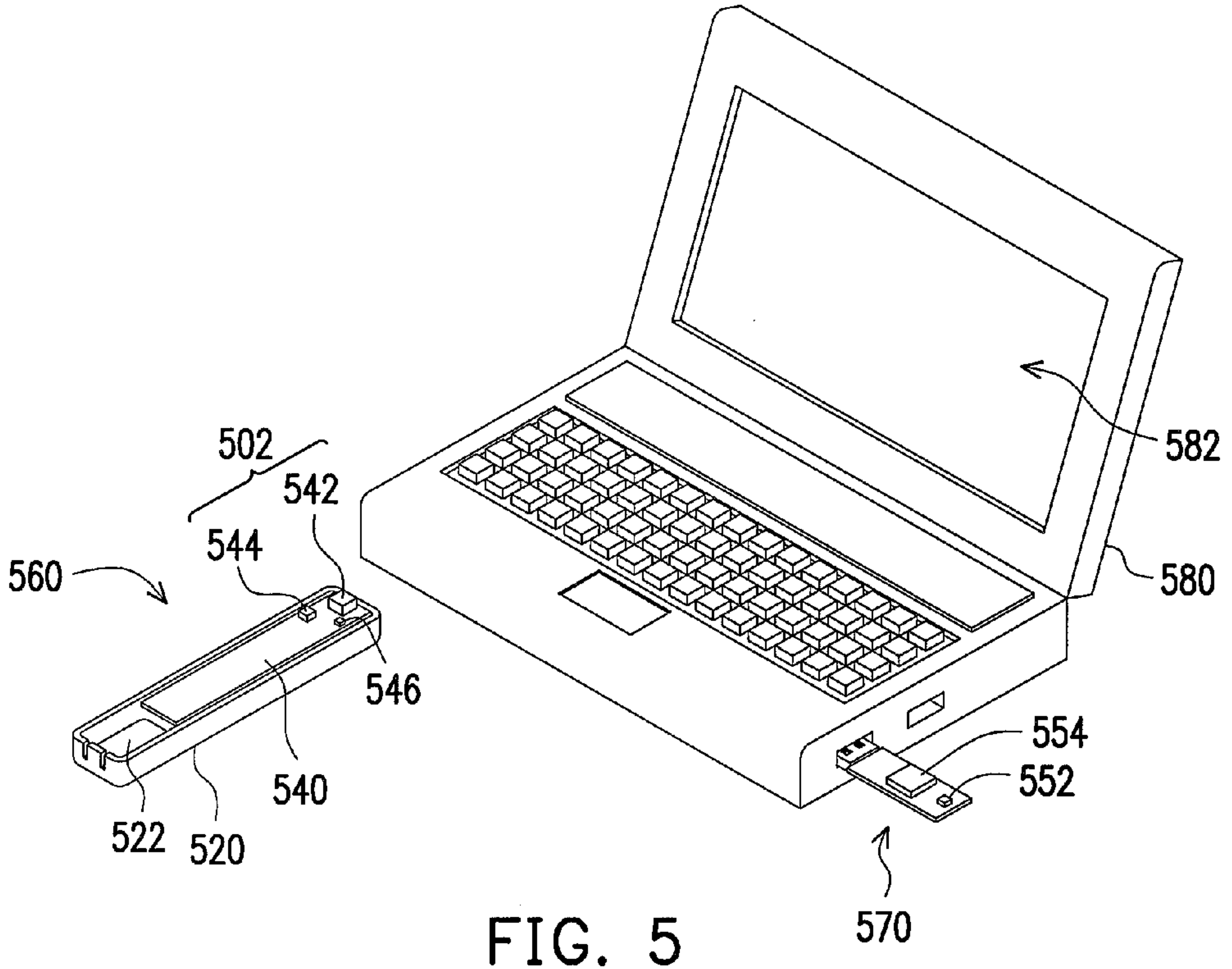


FIG. 5

'438 Patent at Fig. 5

All embodiments are consistent with Samsung's construction

The computing processor **648** of the processing and transmitting module **604** may too perform the mapping of resultant deviation from or in said spatial reference frame or 3D reference frame to a display reference frame such as a 2D reference frame by translating the resultant angles of the resulting deviation of the 3D pointing device **600** in the spatial pointer reference frame, preferably about each of three orthogonal coordinate axes of the spatial pointer reference frame to a movement pattern in a display reference frame associated with the 3D pointing device **600** itself. The display **682** displays the aforementioned movement pattern. The top cover **610** includes a transparent area **614** for the user to see the display **682**.

'438 Patent at 10:29-41;
'978 Patent at 13:48-59

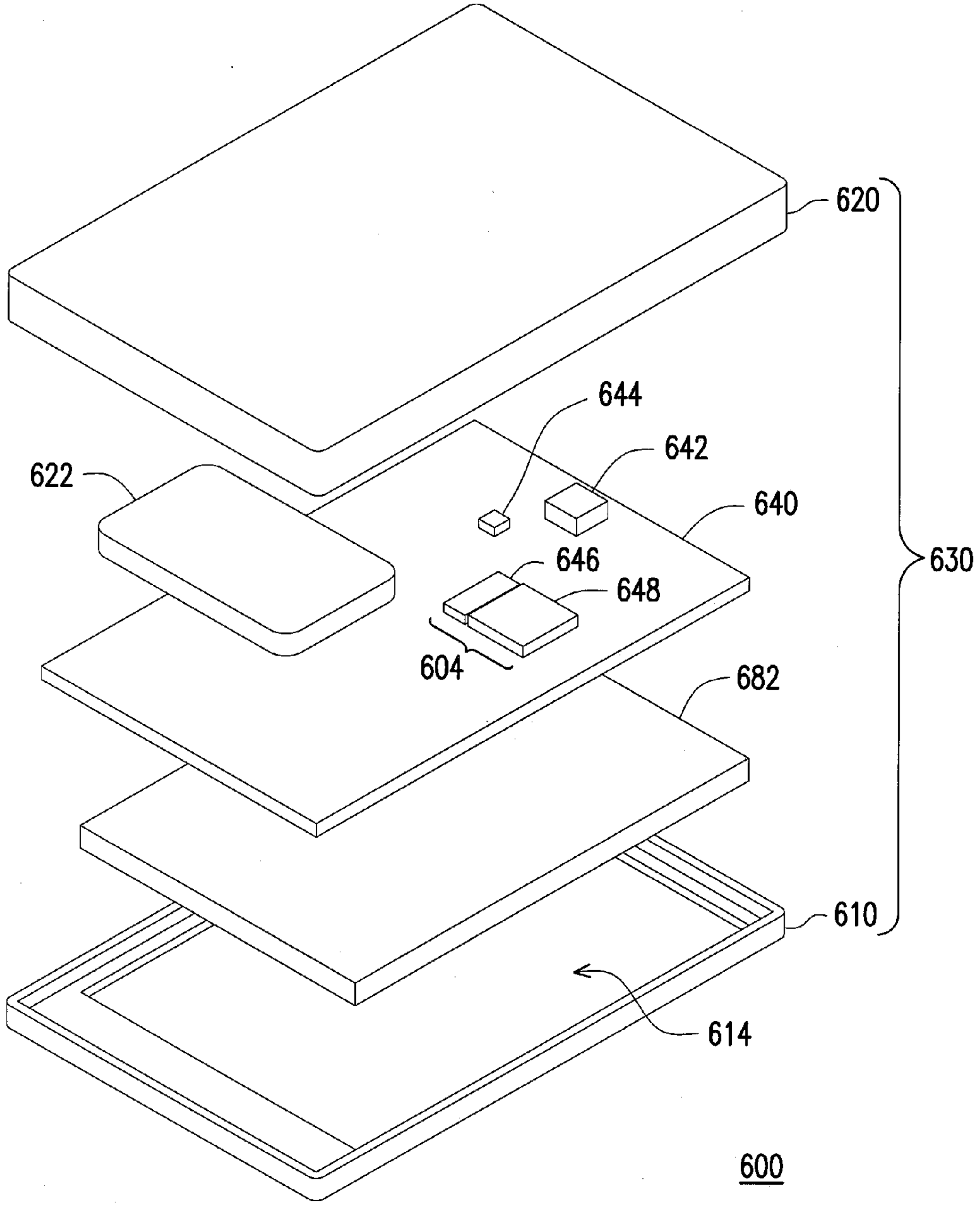
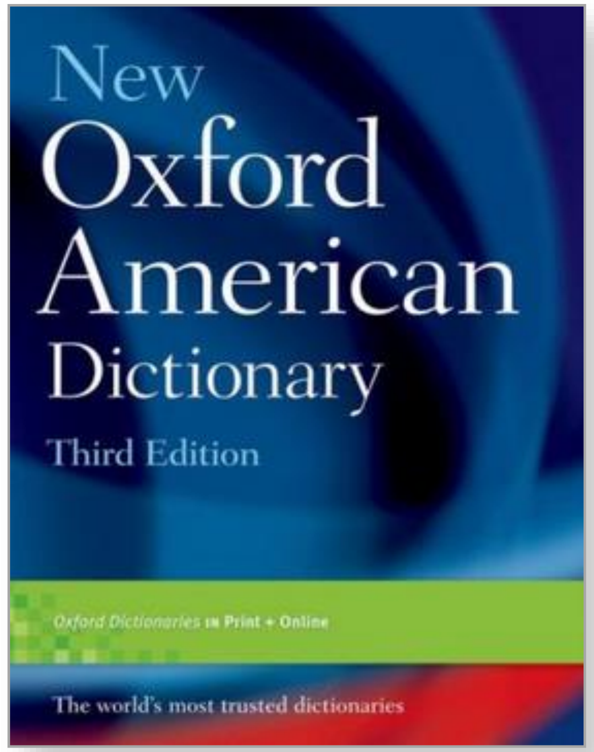


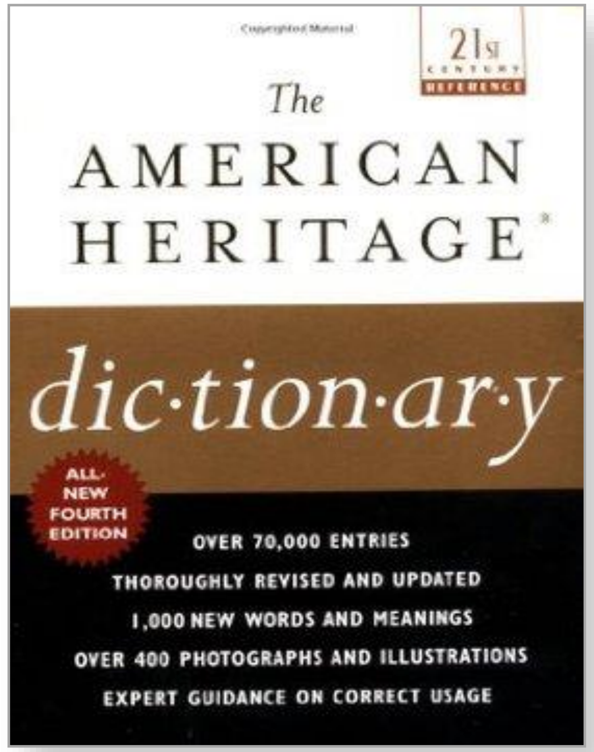
FIG. 6 '438 Patent at Fig. 6

Samsung's construction is consistent with the extrinsic evidence



point•ing de•vice ▸n. Computing a generic term for any device (e.g., a graphics tablet, mouse, stylus, or trackball) used to control the movement of a cursor on a computer screen.

New Oxford American Dictionary (Exhibit 6 to Brann Decl.)



point•ing device (poin′tĭng) *n.* *Computer Science* An input device, such as a mouse, joystick, or trackball, with which one can move or manipulate a cursor or pointer on a GUI.

American Heritage Dictionary (Exhibit 7 to Brann Decl.)

"six-axis motion sensor module"

'438 Patent, Claims 1, 5, 14–17, 19

Samsung's Construction	CyWee's Construction
"a module **consisting** of two types of sensors: (i) a rotation sensor and (ii) one or more accelerometers"	This term need not be construed. In the alternative, this term may be construed as: "a collection of components **comprising** a rotation sensor **comprising** one or more gyroscopes for collectively generating three angular velocities and one or more accelerometers for collectively generating three axial accelerations where said gyroscopes) and accelerometer(s) are mounted on a common PCB"

“six-axis motion sensor module”

- The claim language and the specification support Samsung’s construction.
- CyWee specifically distinguished a nine-axis motion sensor from a six-axis motion sensor during prosecution.
- CyWee’s proposed construction eliminates this distinction and thus cannot be correct.

The claim language supports Samsung's construction

1. A three-dimensional (3D) pointing device subject to movements and rotations in dynamic environments, comprising:

a housing associated with said movements and rotations of the 3D pointing device in a spatial pointer reference frame;

a printed circuit board (PCB) enclosed by the housing;

a six-axis motion sensor module attached to the PCB, comprising a rotation sensor for detecting and generating a first signal set comprising angular velocities ωx, ωy, ωz associated with said movements and rotations of the 3D pointing device in the spatial pointer reference frame, an accelerometer for detecting and generating a second signal set comprising axial accelerations Ax, Ay, Az associated with said movements and rotations of the 3D pointing device in the spatial pointer reference frame; and

a processing and transmitting module, comprising a data transmitting unit electrically connected to the six-axis motion sensor module for transmitting said first and second signal sets thereof and a computing processor for receiving and calculating said first and second signal sets from the data transmitting unit, communicating with the six-axis motion sensor module to calculate a resulting deviation comprising resultant angles in said spatial pointer reference frame by utilizing a comparison to compare the first signal set with the second signal set whereby said resultant angles in the spatial pointer reference frame of the resulting deviation of the six-axis motion sensor module of the 3D pointing device are obtained under said dynamic environments, wherein the comparison utilized by the processing and transmitting module further comprises an update program to obtain an updated state based on a previous state associated with said first signal set and a measured state associated with said second signal set; wherein the measured state includes a measurement of said second signal set and a predicted measurement obtained based on the first signal set without using any derivatives of the first signal set.

’438 Patent at Claim 1

The specification defines “six-axis”

The term “six-axis” means the three angular velocities ωx, ωy, ωz and the three axial accelerations Ax, Ay, Az.

’978 Patent at 10:10-12;
’438 Patent at 8:10-12

The patents distinguish a nine-axis motion sensor from a six-axis motion sensor

Six-axis Motion Sensor

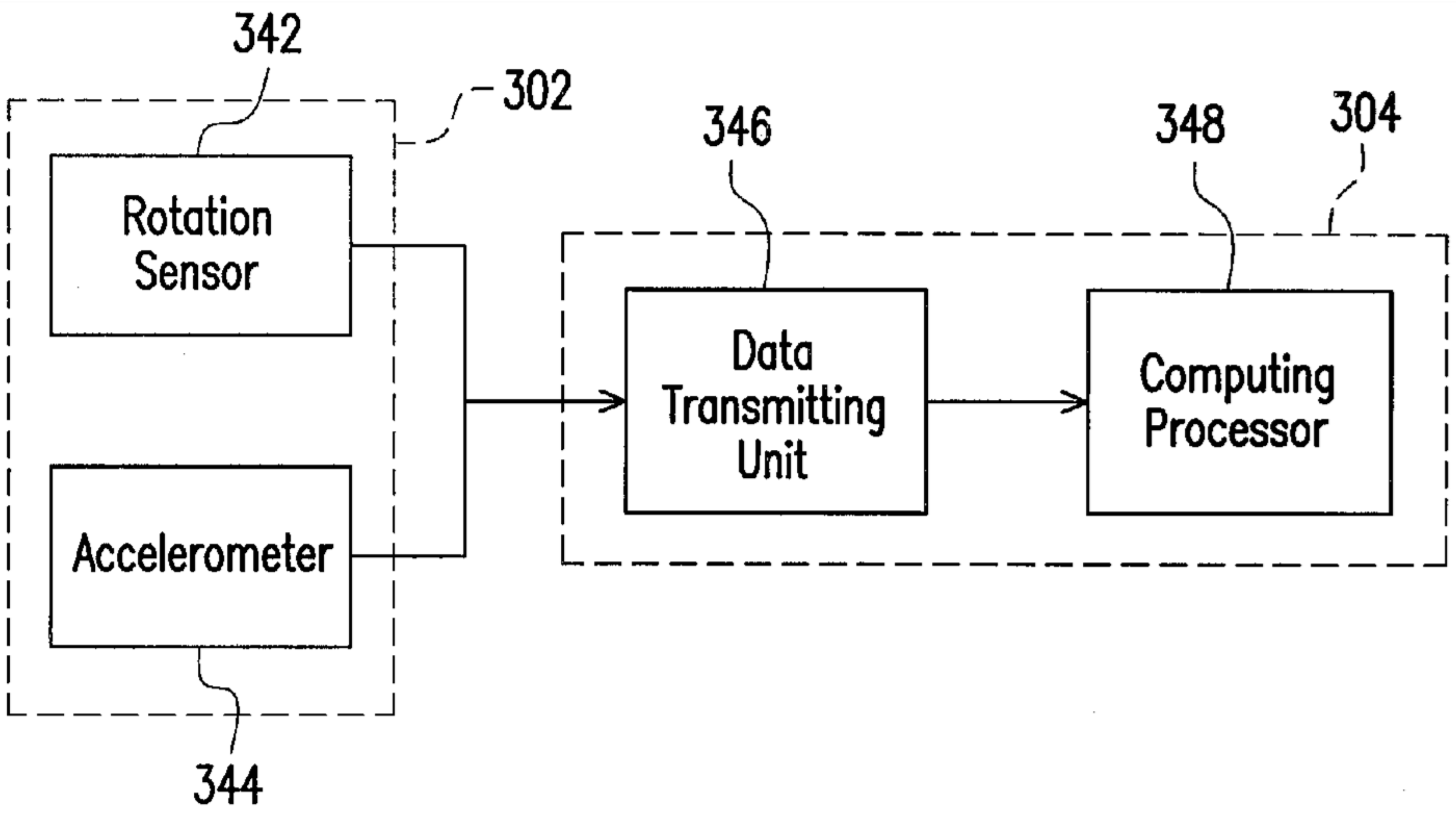


FIG. 4

’438 Patent at Fig. 4

Nine-axis Motion Sensor

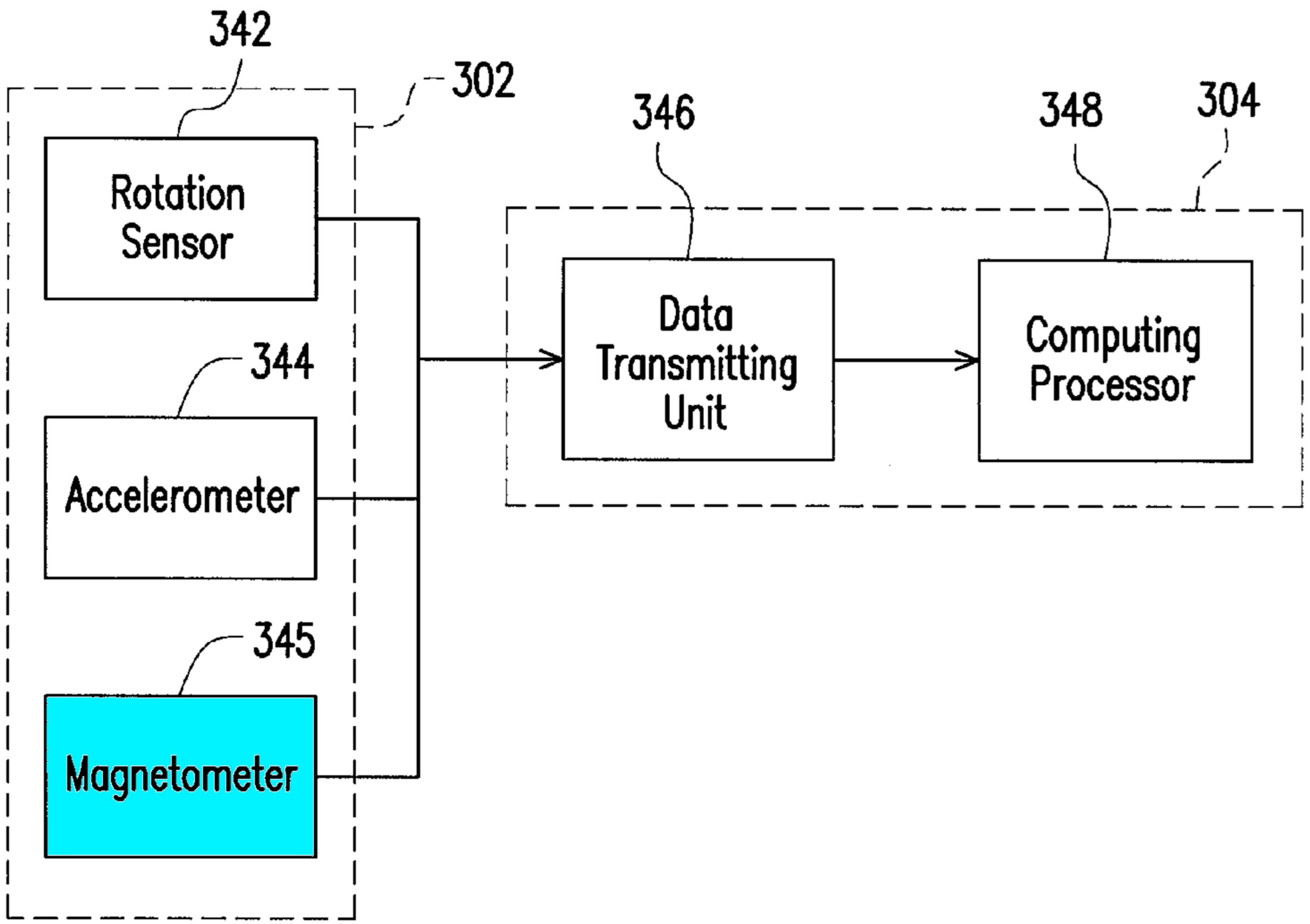


FIG. 4

’978 Patent at Fig. 4

CyWee distinguished a nine-axis motion sensor from a six-axis motion sensor

Applicant submits that Application No. 12/943,034 includes the claimed subject matter of a six-axis motion sensor module without having and using measured magnetisms and predicted magnetisms.

’978 Patent File History (Exhibit 8 to Brann Decl.)

Related patent applications may inform the scope of earlier applications

"[A] statement made by the patentee during prosecution history of a patent in the same family as the patent-in-suit can operate as a disclaimer."

Verizon Servs. Corp. v. Vonage Holdings Corp., 503 F.3d 1295 (Fed. Cir. 2007)

"Any statement of the patentee in the prosecution of a related application as to the scope of the invention would be relevant to claim construction, and the relevance of the statement made in this instance is enhanced by the fact that it was made in an official proceeding in which the patentee had every incentive to exercise care in characterizing the scope of its invention."

Microsoft Corp. v. Multi-Tech Sys., 357 F.3d 1340, 1350 (Fed. Cir. 2004)

“global reference frame associated with Earth”

’978 Patent, Claim 10

Samsung’s Construction	CyWee’s Construction
“an **Earth-centered** coordinate system with an origin and a set of three coordinate axes defined with respect to Earth”	This term need not be construed. In the alternative, this term may be construed as follows: “reference frame with axes defined with respect to Earth”

“global reference frame associated with Earth”

- Both CyWee’s and Samsung’s extrinsic evidence supports Samsung’s construction.
- CyWee relies on reference frames that are not global to expand the meaning of the term.

The extrinsic evidence supports Samsung's construction

- Global reference frames must be Earth-centered

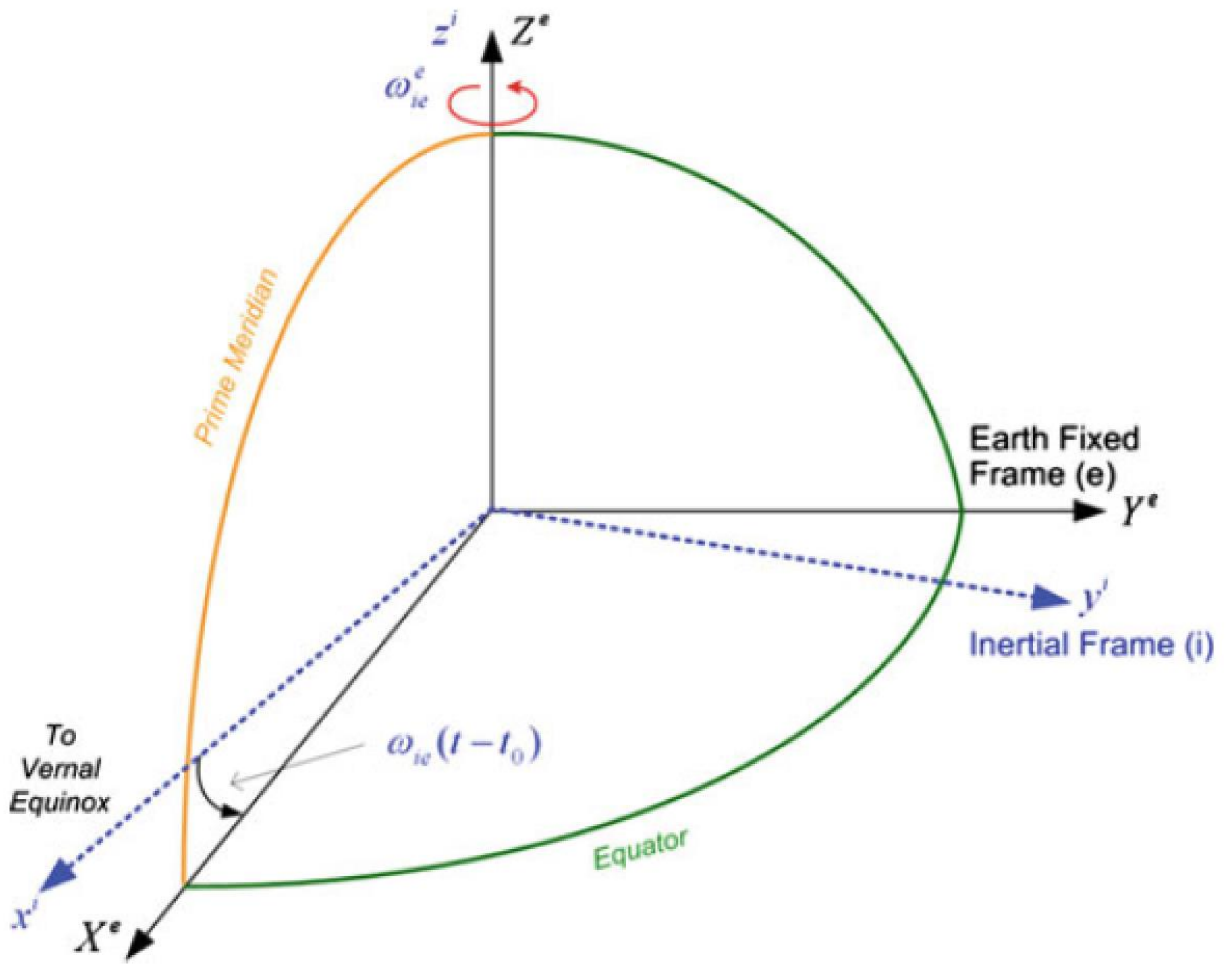


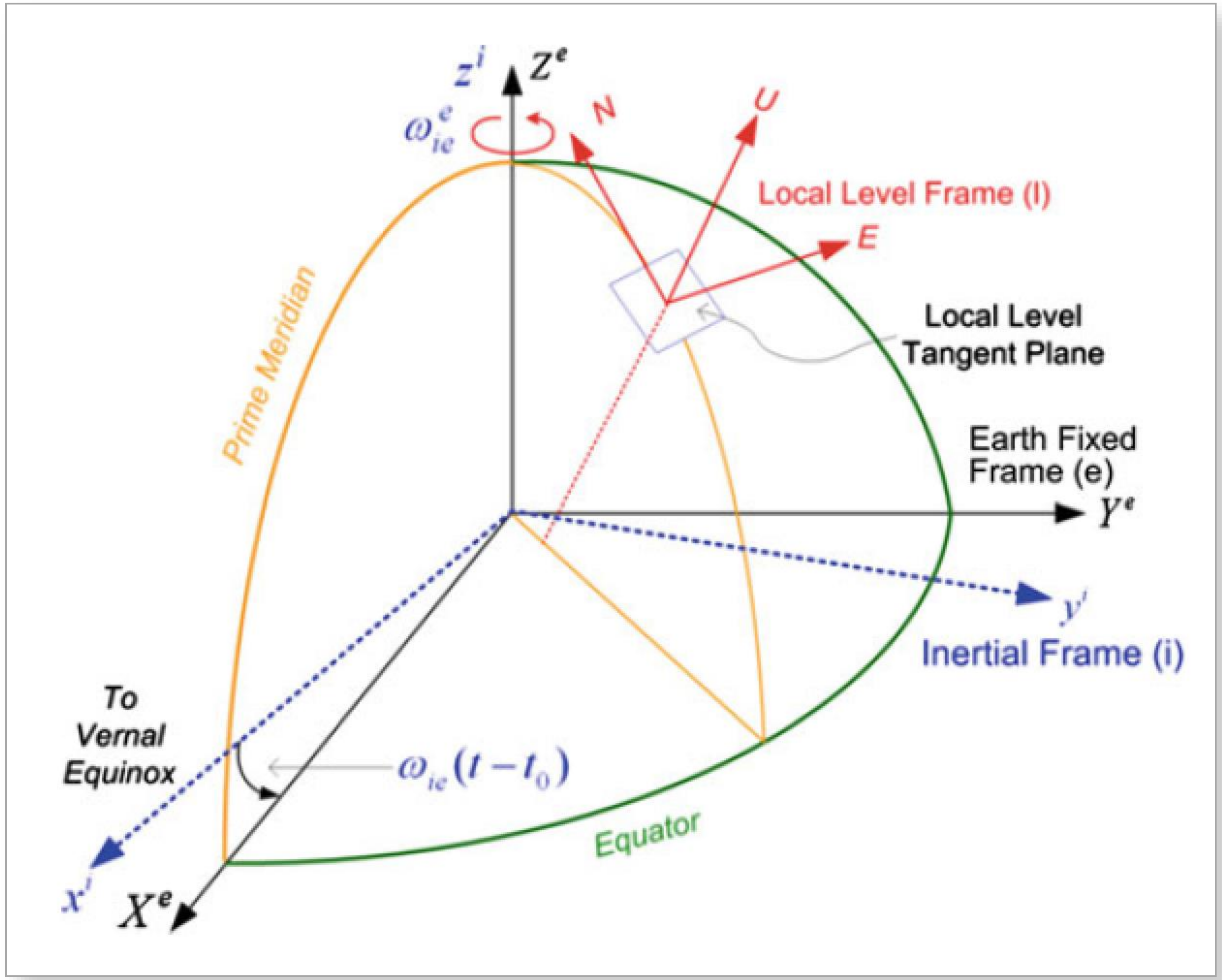
Fig. 2.1 An illustration of the ECI and ECEF coordinate frames

Fundamentals of Inertial Navigation, Satellite Positioning, and their Integration at Fig. 2.1, §§ 2.21-2.22 (Samsung Exhibit 11)

CyWee tries to encompass local frames with its construction

- Unlike a global frame, the origin of a local frame changes with respect to Earth

Local Navigation Frame



Fundamentals of Inertial Navigation, Satellite Positioning, and their Integration at Fig. 2.2 (Samsung Exhibit 11)

“using the orientation output and the rotation output to generate a transformed output associated with a fixed reference frame associated with a display device”

’978 Patent, Claim 10

Samsung’s Construction	CyWee’s Construction
“using the orientation output and the rotation output to generate a transformed output **representing** a two-dimensional movement in a fixed reference frame that is parallel to the screen of the display device”	“using the orientation output and the rotation output to generate a transformed output **represented by** a 2-dimensional movement in a fixed reference frame that is parallel to the screen of a display device”

The specification resolves the dispute

In step **1340**, the rotation sensor **342** generates a rotation output associated with the rotation of the 3D pointing device associated with the three coordinate axes of a spatial reference frame associated with the 3D pointing device itself (such as the reference frame XPYPZP shown in FIG. 1 and FIG. 2). In step **1360**, the computing processor **1420** uses the orientation output and the rotation output to generate a transformed output <dx, dy> associated with the fixed reference frame associated with the display device. The transformed output <dx, dy> represents a 2-dimensional movement in a display plane in the fixed reference frame parallel to the screen of the display device, such as the display plane XDYD of the display device **120** shown in FIG. 1 and FIG. 2, wherein dx represents the movement along the XD axis and dy represents the movement along the YD axis. In addition, the transformed output <dx, dy> may represent a segment of movement in the display plane. Multiple segments of movement plotted by the 3D pointing device may constitute a movement pattern in the display plane and the display device may be controlled to move a virtual object or a cursor along the movement pattern.

’978 Patent at 31:51-32:3